Engineering Automation Considerations

1. This enclosure was developed to highlight some of the more significant engineering automation differences between 46 CFR Subchapter L (OSVs), 46 CFR Subchapter F (Marine Engineering) and SOLAS. This enclosure will undoubtedly become obsolete over time as changes to Coast Guard regulations and SOLAS occur. Applicable Coast Guard regulations and SOLAS requirements will always prevail. This enclosure should **NOT** be used alone, as it is only intended to point out some of the more significant engineering automation differences between 46 CFR Subchapter L, 46 CFR Subchapter I and SOLAS.

2. **Offshore Supply Vessel (L)**

a. Qualitative Failure Analysis (QFA) and Design Verification Testing Procedure (DVTP) are required for the remote or automatic propulsion controls.

b. Single non-concurrent failure of each easily replaceable component of the propulsion automatic or remote controls must not cause the propulsion engine, or the pitch of the propeller, to increase. Alternative manual means of propulsion control is required.

c. Propulsion control in the pilothouse is required.

d. Required alarms are very limited, and are only required for unattended machinery spaces.

e. Test procedures (periodic safety test procedures) and operations manual are required only for unattended machinery spaces.

f. For unattended machinery spaces, machinery displays (instrumentation) are required to be grouped or centralized in the machinery space.

3. **Sub I Vessel (>500 GT)**

a. A QFA is required for the automated systems listed in 46 CFR 62.20-3(b). Whenever a QFA is required, a DVTP document is also required.

b. Propulsion control failures are required to be failsafe, i.e., speed and direction of thrust maintained, until local manual or alternate manual control is in operation. Failures are required to be alarmed in the navigating bridge and the machinery spaces. NOTE: Credit is given to vessels with “independent duplicate propulsion systems”, i.e., a vessel with multiple propellers with independent controls, do not have to maintain the speed and direction of thrust of the affected propulsion plant, provided the reduced propulsion capability of the vessel using the remaining propulsion plant(s) is not below that necessary for the vessel to run ahead at 7 knots or half speed, whichever is less, and is adequate to maintain control of the ship.

c. Propulsion controls in the pilothouse are not required for a vessel with a fully-manned machinery plant operation, implying propulsion control in the machinery spaces is required.

d. If pilothouse control is provided, a means to pass propulsion orders (EOT) between the navigating bridge and the engineroom is required. Normal propulsion control transfers require acknowledgement from the receiving station. Control location transfer between control stations required. Engine control room station must have means to take propulsion control from the navigating bridge or any other secondary control stations at any time. Local manual control must have the capability to override all remote and automatic control locations.

e. Two sources of power are required for all primary control, safety control, instrumentation and alarm systems. One source must be from the emergency power source. Alarms are required to be continuously powered (typically provided by UPS or batteries.)

f. **Additional requirements for <u>fully manned machinery spaces (46 CFR 62.30 and 62.35)</u>**. This is NOT a comprehensive list.

(1) Primary closed loop propulsion control systems must be independent and physically separate from required safety control, alarm or instrumentation sensors.

(2) Propulsion machinery automatic safety trip control is required if continued operation could result in serious damage, complete breakdown, or explosion of the equipment.

(3) Remote controls for flooding safety equipment must remain functional under flooding conditions.

(4) Fire pump remote controls must include a firemain pressure indicator or firemain low pressure alarm.

(5) Automatically filled fuel oil day tanks, settlers, and similar fuel oil service tanks that are filled automatically or by remote control must have high level alarm that annunciates in the machinery spaces, and an automatic fuel-fill shutdown control system or overflow arrangement.

(6) Starting capacities for main engines and ship's service generator prime movers require a certain number of consecutive starts, depending on type of starting system and propulsion engine.

g. **Additional requirements for <u>minimally attended</u> machinery plant operation (46 CFR 62.50-20).** This is NOT a comprehensive list.

(1) ECC must include control and monitoring of:

(a) propulsion plant, propulsion auxiliaries,

(b) electrical power generation,

(c) machinery space fire pump,

(d) bilge pump control to counter machinery space flooding, and

(e) the ability to place on-line the required standby systems (unless systems are automatically controlled) and to shutdown such equipment when necessary.

(f) Minimum alarms and instrumentation are specified in 46 CFR Table 62.35-50.

(2) Personnel alarm (dead-man alarm) required.

(3) Machinery space fire alarms must activate alarms throughout the machinery spaces and engineers' accommodations. The fire alarms in the ECC and navigating bridge must visually indicate which machinery space is on fire.

(4) Watertight doors in required subdivision bulkheads must be Class 3 watertight doors, and must be controlled from the ECC and navigating bridge.

(5) Controls of sea inlet and discharge valves, and the emergency bilge suction, must be located and arranged to allow time for operation in the event of flooding. Time consideration in the proper location of the valve operators, must include flooding detection, crew response and valve control operation time.

(6) Engineers' call system (operable from the ECC) required.

(7) ECC must have controls and instrumentation necessary to place the ship's service and propulsion generators in service in 30 seconds.

(8) Switchboard distribution, propulsion and generator controls must be located in the ECC, or additional requirements apply if located outside the ECC.

(9) Maintenance program required.

h. **Additional requirements <u>for periodically unattended machinery plant</u> operation (46 CFR 62.50-30)**. This is NOT a comprehensive list.:

(1) Required redundant vital auxiliaries and power sources must automatically transfer to the back-up unit upon failure of the operating units.

(2) Capacity of fuel oil service tanks to be determined by the OCMI, depending on the route of the vessel, otherwise, must be sufficient for 24-hour operation at normal power, 8 hours for automatically filled tanks. Low fuel oil level alarm is required.

(3) Starting system receivers, accumulators or batteries must be automatically and continuously charged.

(4) Engineer's assistance needed alarm must be activated when the alarm system normal source of supply fails, and when an alarm at the ECC is not acknowledged within a period of time where an engineer is expected to respond to the alarm.

(5) ECC alarms that require immediate attention of the navigating bridge officer for the safe navigation of the vessel must be extended to the pilothouse.

(6) All required ECC alarms must be extended in the engineers' accommodations. This may be in the form of a summary alarm.

(7) Fire and flooding alarms must not be summarized.

(8) A fire control station is required. The station must be outside the machinery spaces.

(9) Daily check-off list must be completed prior to leaving the machinery plant unattended.

(10) Standby ship's service generator must automatically start and assume the ship's service loads within 30 seconds to permit propulsion and steering, and to ensure the safety of the vessel, and automatic restarting of essential auxiliaries. The emergency generator is not considered for this purpose. See item 4.e.(4) below under SOLAS which allows the administration to dispense with the continuity of power requirements outlined in this paragraph for vessels of less than 1600 gross tons.

(11) If ship's service power is supplied by more than one generator in parallel operation, provisions to prevent overload of the remaining generator to ensure the remaining generator are kept in operation to permit propulsion and steering, and to ensure the safety of the vessel.

4. **SOLAS**

a. Contains no provisions to verify compliance with the failsafe regulations.

b. Same as Paragraph 3.b (above), for Subchapter I vessels, except the NOTE does not apply for SOLAS vessels.

c. Propulsion controls required in the navigating bridge for periodically unattended machinery plant operation.

d. Provisions for continuous manual supervision from a control room is similar to a minimally manned machinery plant operation for Sub I vessels, Paragraph 3(g), above.

e. Additional requirements for **periodically unattended machinery spaces**:

(1) Crankcase oil mist detectors or bearing engine temperature monitors or similar devices are required for internal combustion engines of 2250kW and above or

having cylinders of at least 300 mm bore. As per D8(m) Policy Letter 05-2001: It has been determined by G-MSE that high crankcase pressure switches are an equivalent to oil mist detectors, required by SOLAS II-1/47.2, on medium sized (900 to 5000hp) Electro-Motive Division (EMD) General Motors Corp two cycle engines. The difference between the two systems is that the detector senses misted oil and a high crankcase pressure switch senses the loss of a vacuum in the crankcase. The intent of both systems is to prevent the occurrence of a crankcase fire as a result of a mechanical engine failure by signaling an alarm and /or shutting down the engine.

(2) The number of consecutive automatic starts of propulsion machinery must be limited and alarmed. The low starting air pressure alarm must be set at a level to permit starting operations of the propulsion machinery locally. This typically applies to reversible main engines.

(3) SOLAS II-2/14 Fixed fire detection and fire alarm systems for periodically unattended machinery spaces. A fixed fire detection system and fire alarm system of an approved type in accordance with the relevant provisions of regulation 13 shall be installed. Another area of concern is regulation 14.2 which states; except in spaces of restricted height and where their use is specially appropriate, detection systems using only thermal detectors shall not be permitted.

(4) The administration may dispense with the continuity of power requirements outlined in paragraph 3.h.(10) above for vessels of less than 1600 gross tons.